

## Mitigating the Possibility of Contact with High Voltage While Working on Liquid Argon Calorimeter Systems

### Revision Log

Version Number	Date Approved	Pages Affected	Description of Revisions
1.0	12/14/00	All	Initial Issue

### Approvals

P.M. Tuts  
Calorimeter Group Leader

12/14/00  
Date

Rick Hance  
Project Electrical Engineer

12/14/00  
Date

William S. Freeman  
Asst. Project Manager

12/14/00  
Date

## TABLE OF CONTENTS

1	Introduction.....	3
1.1	Purpose .....	3
1.2	Scope and Applicability .....	3
2	Precautions and Limitations .....	3
3	Prerequisite Actions .....	3
3.1	Equipment .....	3
4	Procedure .....	4
4.1	Power Supply Disablement .....	4
4.2	Disconnecting Cables .....	4
4.3	Restoring Service .....	5

# **1 INTRODUCTION**

## **1.1 Purpose**

This procedure provides instructions on how to safely avoid contact with bias voltages from the DØ high voltage system while working on DØ liquid argon calorimeter systems.

## **1.2 Scope and Applicability**

The calorimeter high voltage is normally controlled by software operated by detector experts or shift personnel from the DØ control room. Since the Liquid Argon Calorimeter cryostats are completely sealed, the only occasion when there is risk of exposure to high voltage is when work needs to be done on the high voltage cabling, or to the high voltage modules and fanouts, or to the filter capacitor systems. Following this procedure is required of anyone who may be exposed to bias voltages from the DØ high voltage system while working on any of the Liquid Argon Calorimeter systems. The Calorimeter Group Leader shall insure that such workers are competent in the use of this procedure.

This procedure does not address the maintenance or repair of calorimeter high voltage supplies.

# **2 PRECAUTIONS AND LIMITATIONS**

- A. Failure to follow this procedure could result in surprising and/or painful electrical shock, with added risk because calorimeter work sometimes occurs on ladders or elevated platforms.

# **3 PREREQUISITE ACTIONS**

## **3.1 Equipment**

- [1] Obtain electrostatic voltmeter and SHV shorting connector (if needed).

## 4 PROCEDURE

### 4.1 Power Supply Disablement

- [1] Inform the DØ Control Room shift personnel (if present) that work is going to be performed on the calorimeter system.
- [2] Do one of the following:
  - [a] Request that the shift personnel set the software controls to the DISABLED state for the relevant supplies.
  - [b] Turn off the high voltage(s) to the relevant detector components by setting their software state to DISABLED.
  - [c] Turn off the power supply to the relevant crate(s).
- [3] Verify that the high voltage has been disabled.
- [4] IF work is expected to take more than one hour, THEN do the following:
  - [a] Place caution tags on the relevant crate(s);
  - [b] Place a note on the software control window in the DØ Control room;
  - [c] Place a note in the control room logbook, concerning the work.

### 4.2 Disconnecting Cables

**NOTE:** *About a minute after disabling the high voltage, most of the stored charge in the cables and high voltage modules will have dissipated through resistors in the high voltage modules. Disconnect cables as close to the detector as possible to minimize the risk. The normal and preferred situation is to disconnect cables only at the capacitor boxes, underneath the preamp boxes, and leave them connected at the HV module end to maintain a discharge path. If cables need to be unplugged at the high voltage modules or anywhere in between, care must be taken to discharge any stored charge in the cables and filter capacitors. An SHV shorting connector is useful for this purpose. The calorimeters themselves also have a large capacitance and can store charge for long periods, so cables with one end remaining connected to the calorimeter and the other end disconnected should be shorted as well.*

*If high voltage of a few thousand volts has been applied for several hours and then a cable is disconnected without a discharge path, stored charge in the cable dielectric will leak out and recharge the cable. Typical*

## 4.2 Disconnecting Cables (continued)

*recharge voltages are about 10% of the applied high voltage (i.e. ~ 250 volts for the calorimeter.)*

- [1] Disconnect high voltage cables, as needed.
- [2] Discharge cables and capacitors, using the shorting connector, if necessary.
- [3] Verify discharge of high voltage using the electrostatic voltmeter.

## 4.3 Restoring Service

- [1] Remove any shorting connectors and plug the high voltage cables back into their connectors to the detector or the modules from which they were disconnected, after completing work.
- [2] Verify that no one else is working on the high voltage system.
- [3] Restore the relevant high voltage to the appropriate condition (either stand-by or 100%), or ask the shift personnel on duty to do it.
- [4] IF caution tags and/or console notes were used, THEN remove them.
- [5] IF an entry was placed in the control room logbook concerning the work, THEN indicate in the logbook that the work was completed.